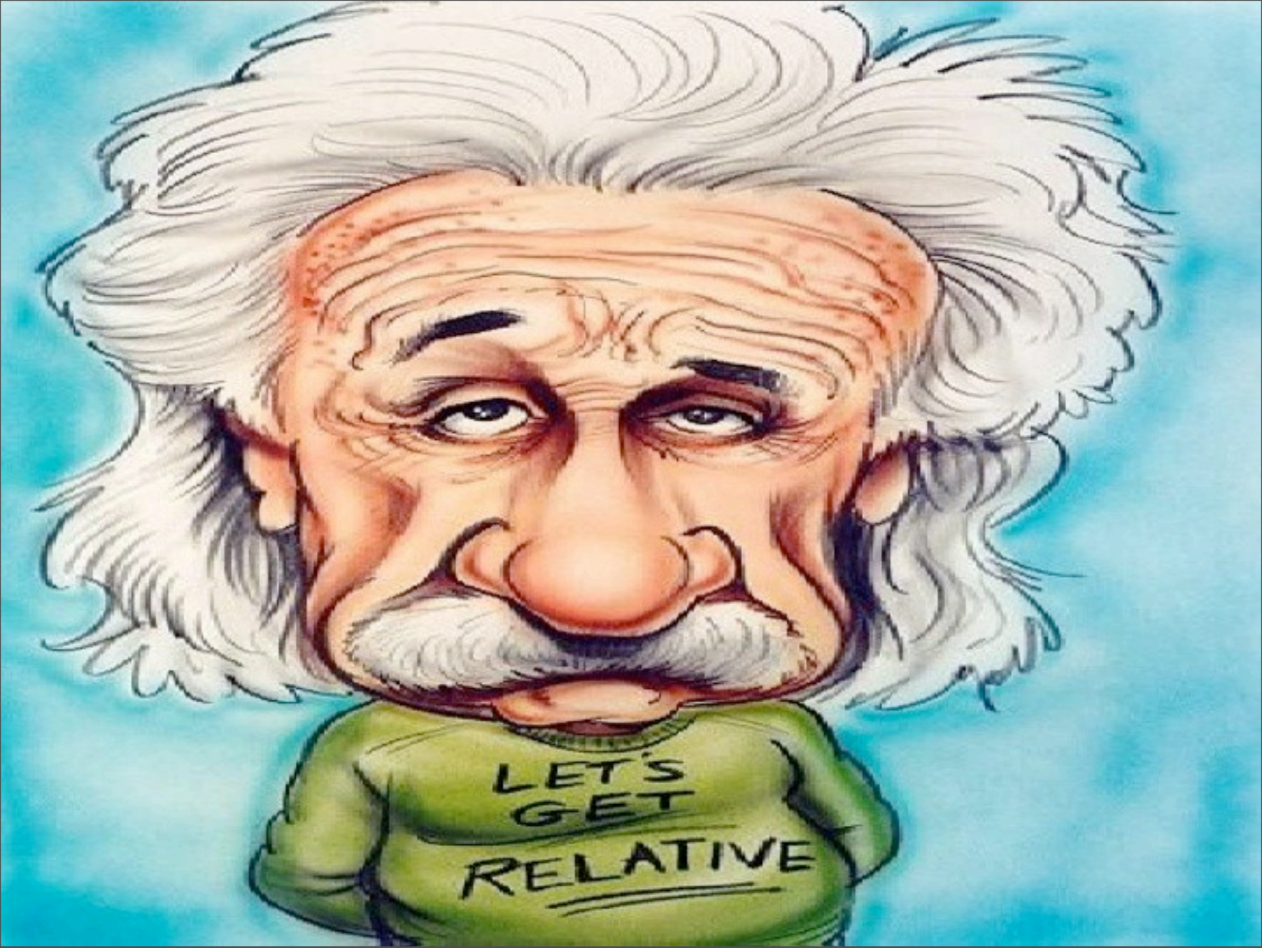
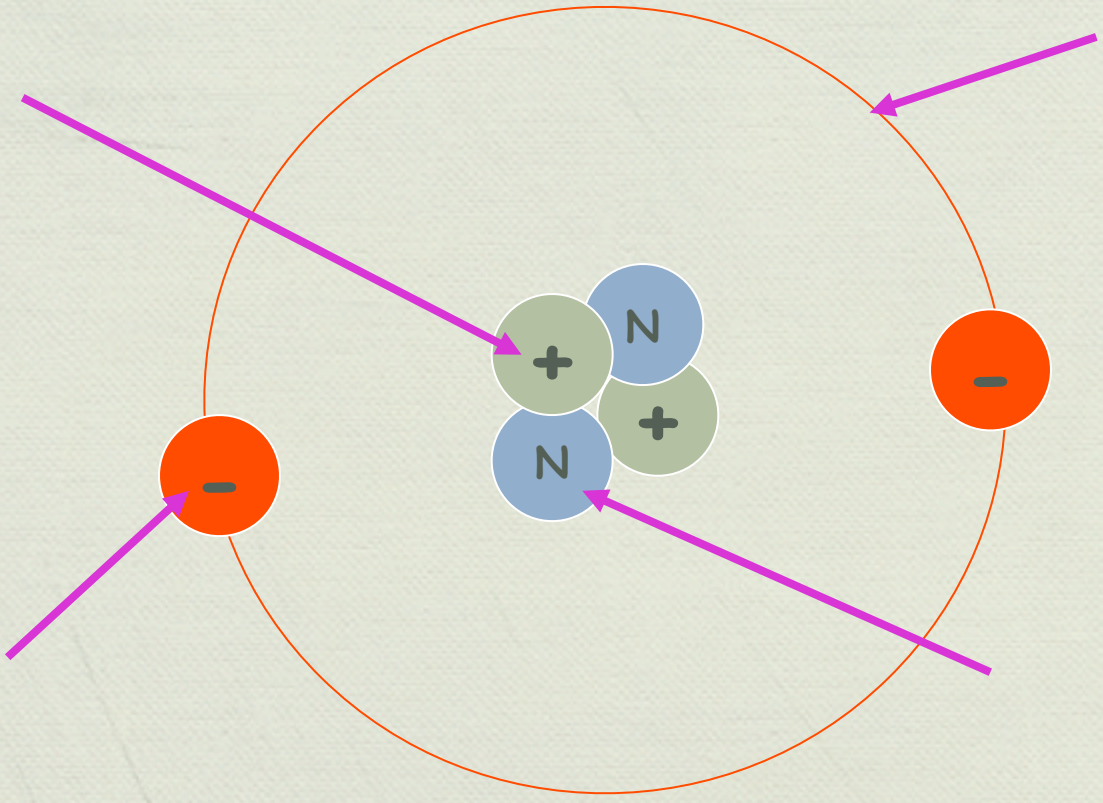
- DSHS Physical Science

HISTORY OF THE ATOM


LET'S
GET
RELATIVE

I. The Atom



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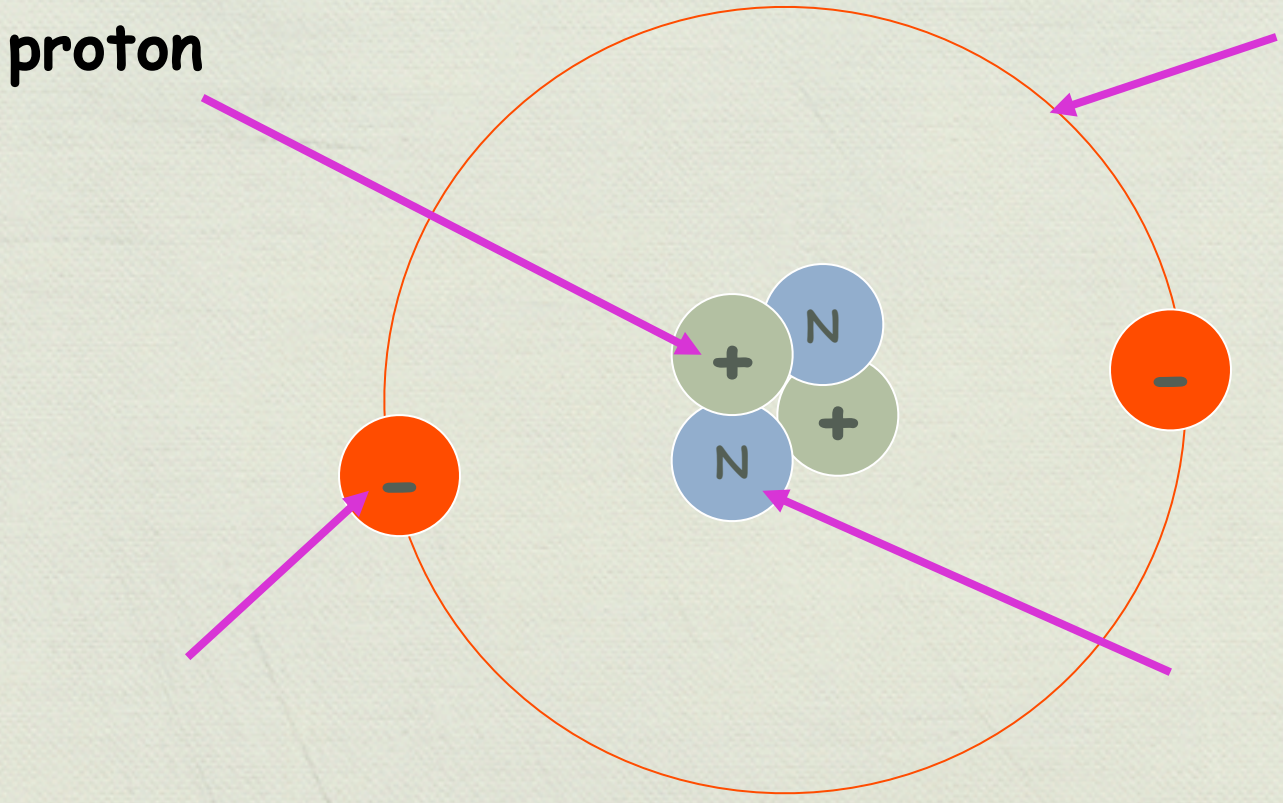

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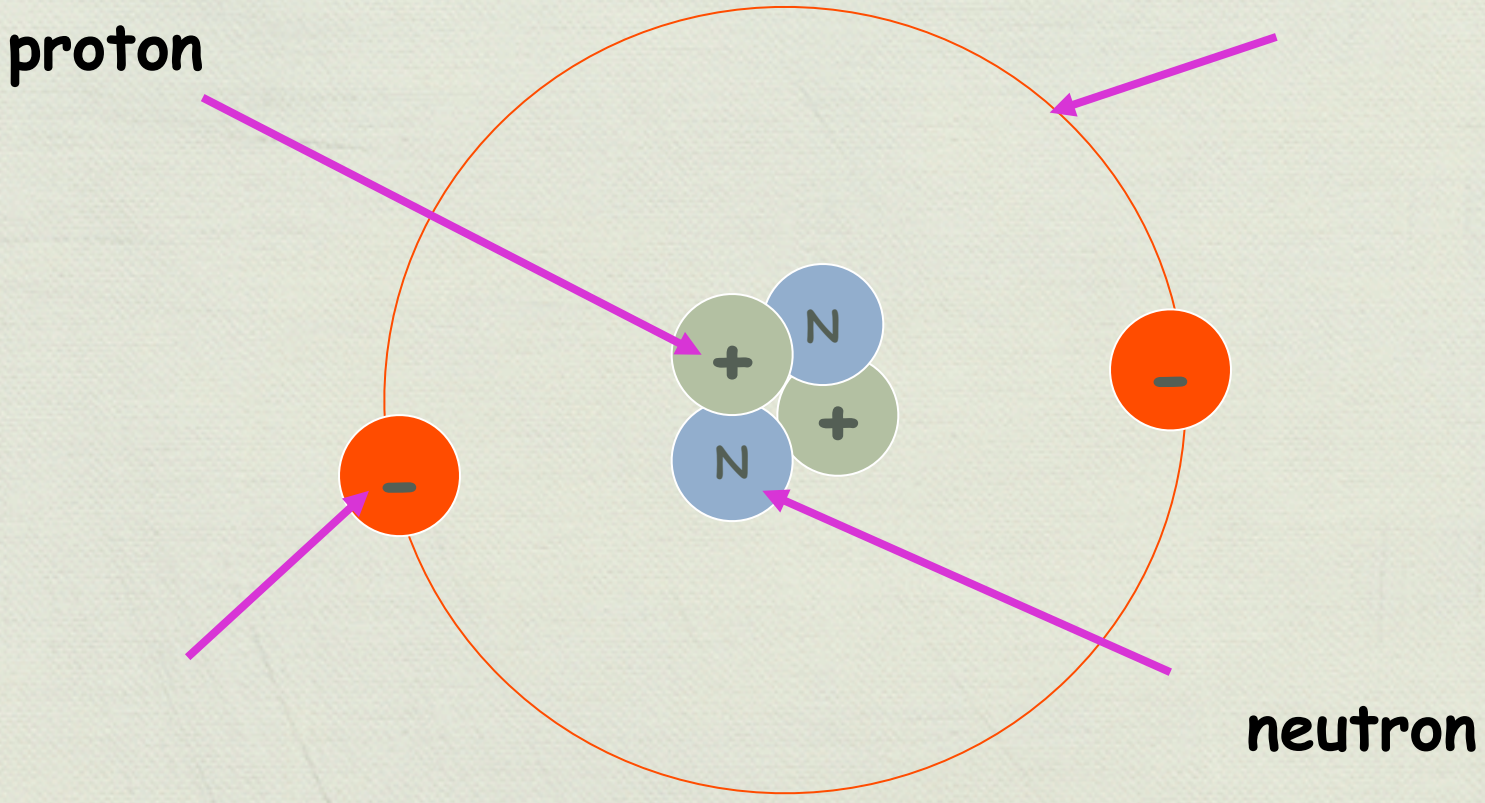

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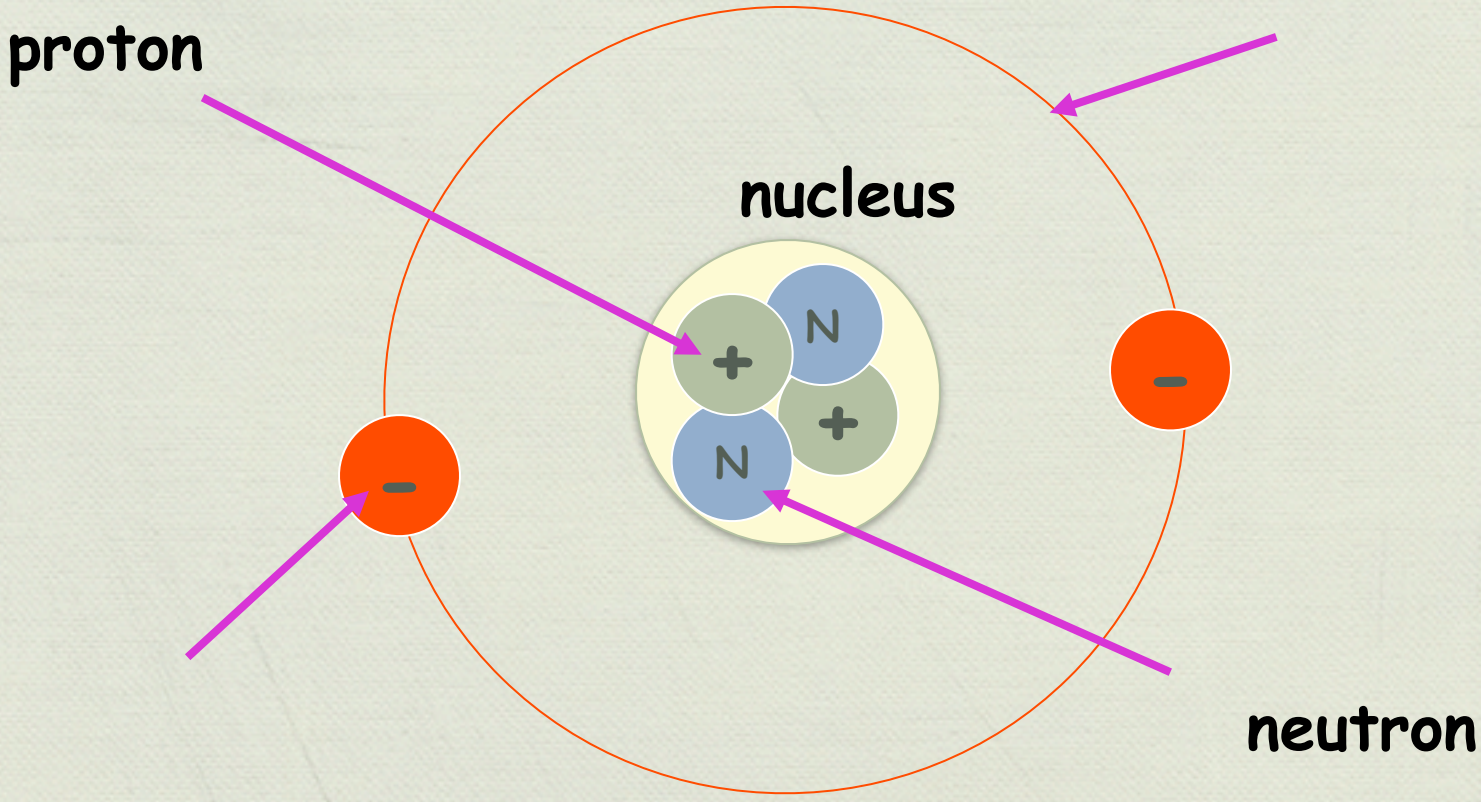

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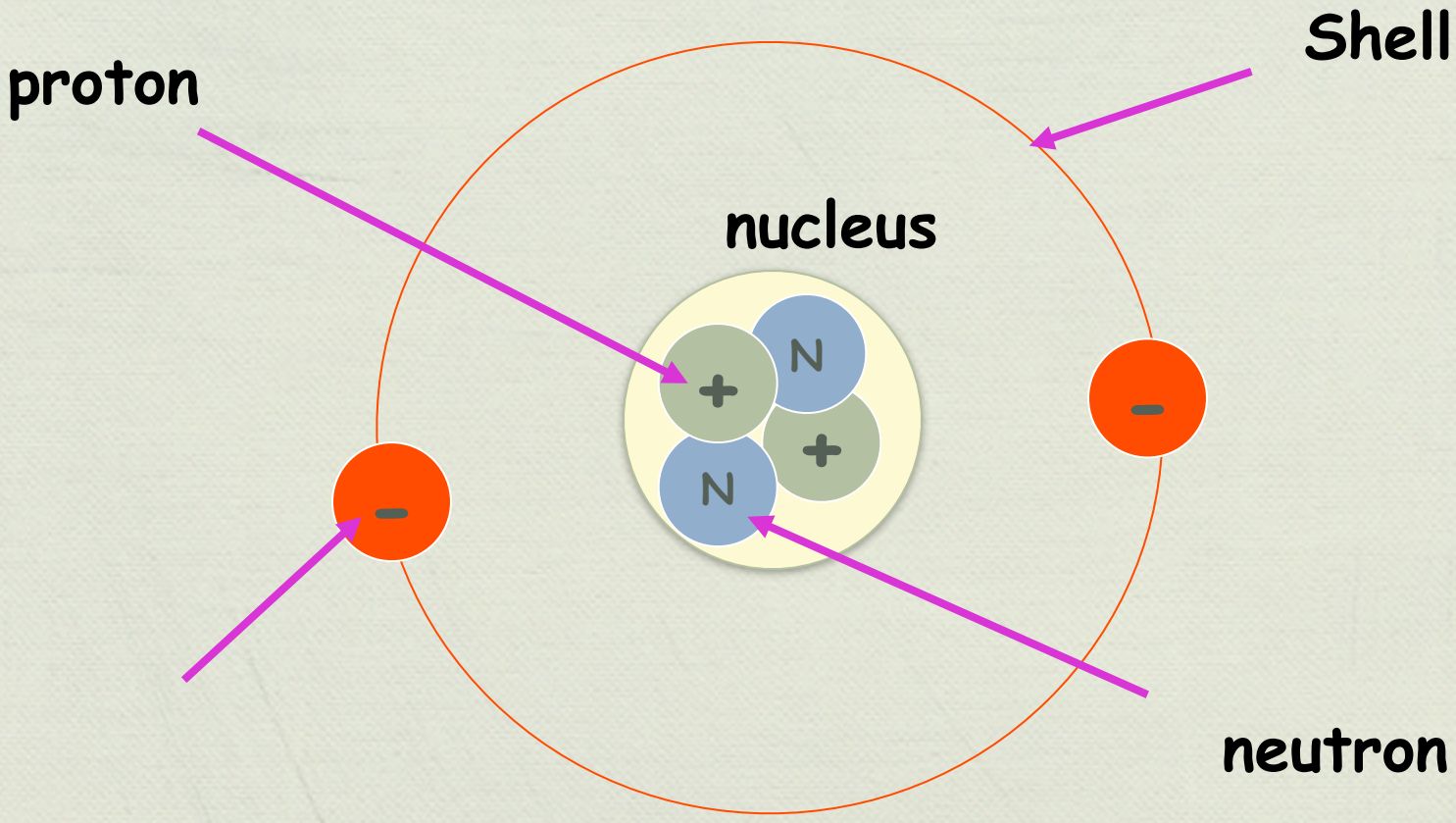

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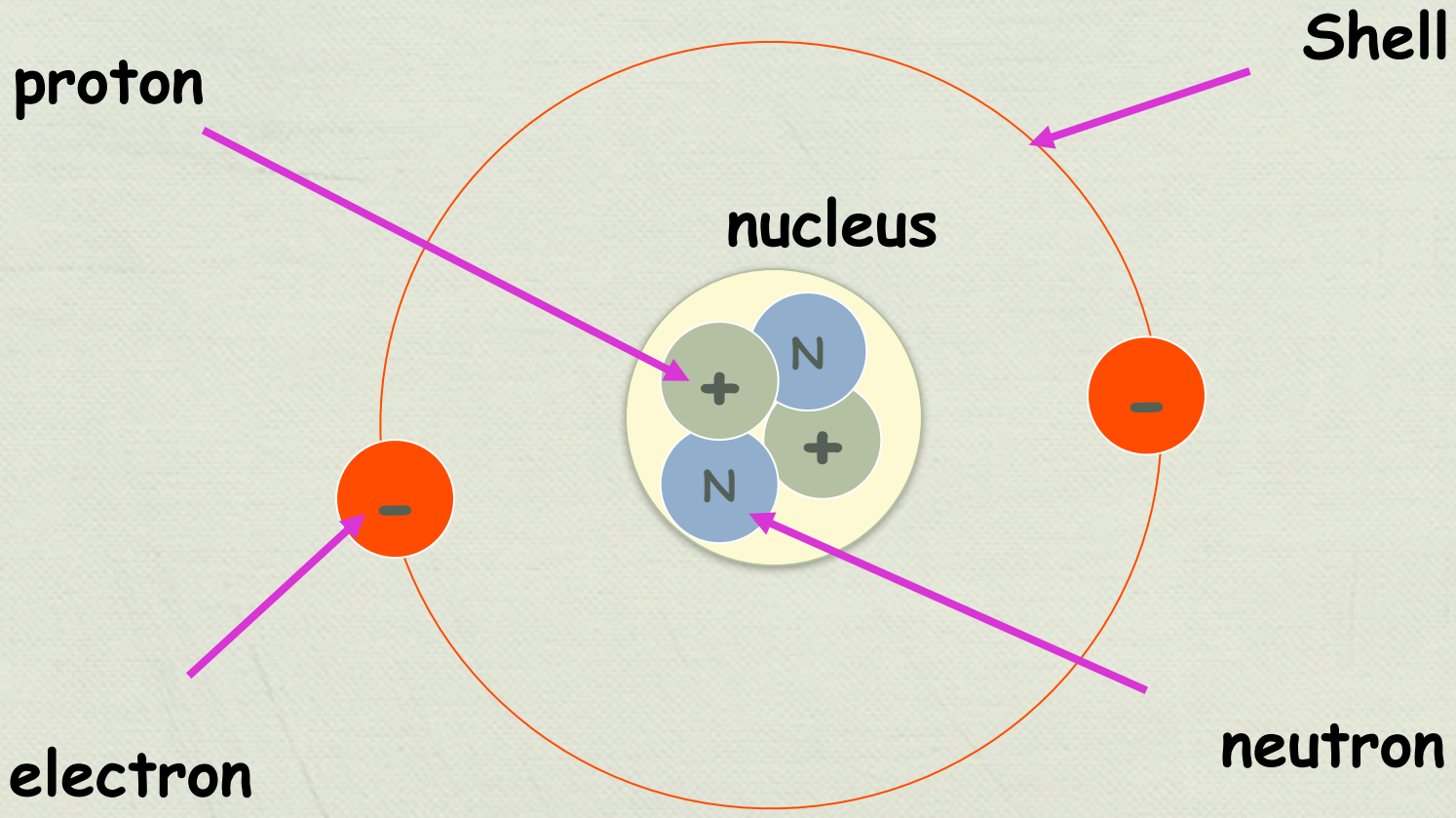

II. Timeline of the Atom

A. 460 BC Democritus develops idea of atoms

1. he pounded up materials until he reduced them to smaller and smaller particles which he called

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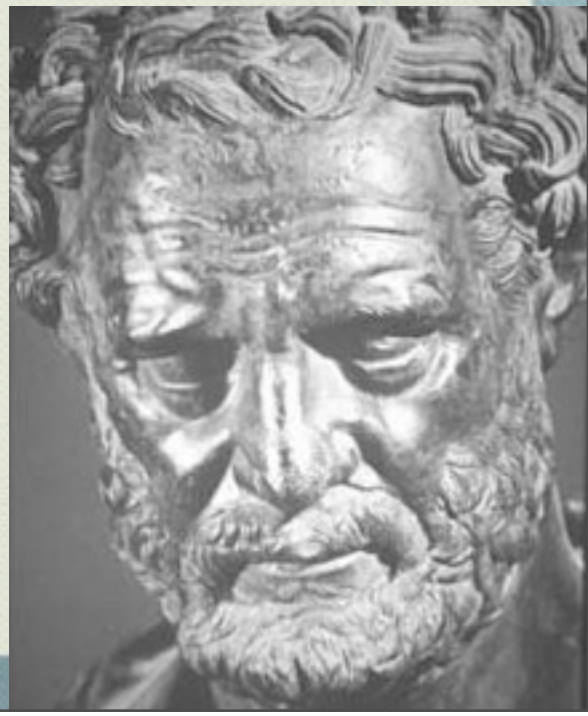

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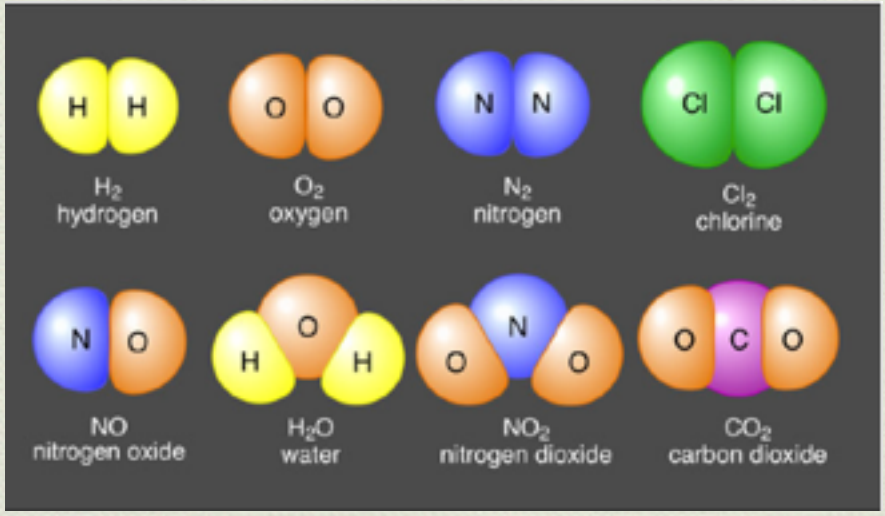
ATOMS

2. Atoms of a given element are <u>exactly alike</u>

-Atoms can join together (like or different types of atoms) the result is a molecule.

-When atoms of different types (different elements) join together, this is called a <u>compound</u>.



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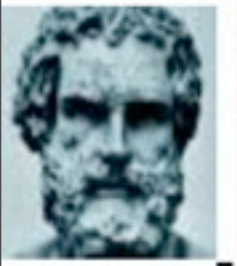

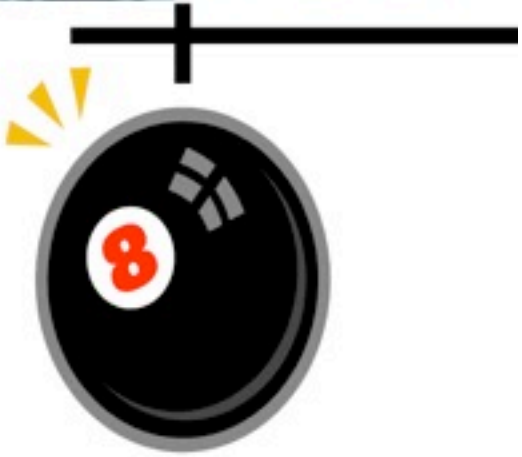

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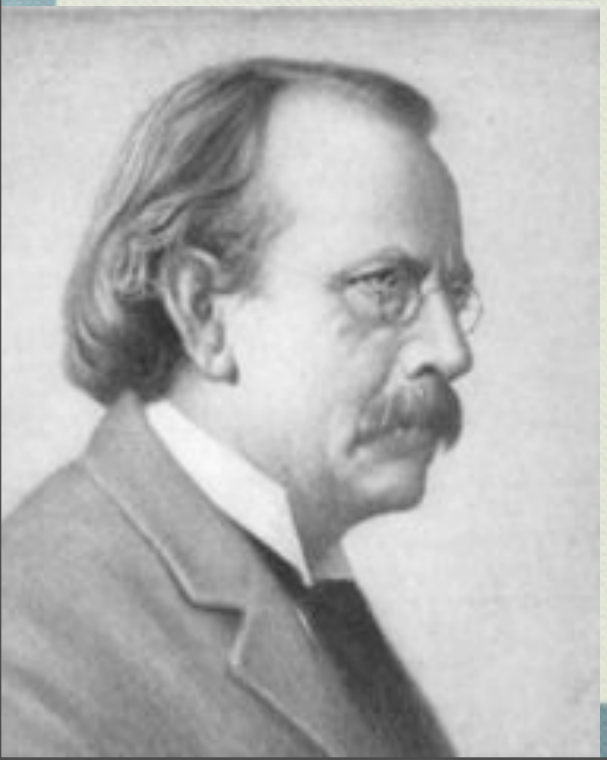

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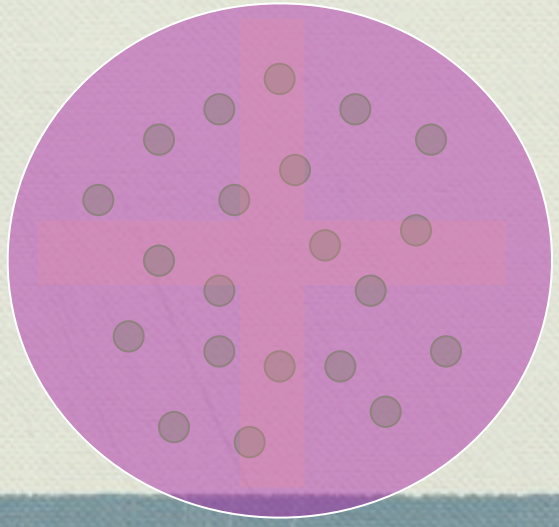

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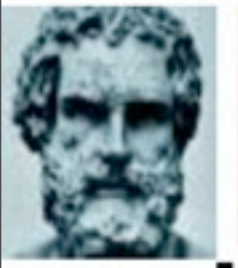

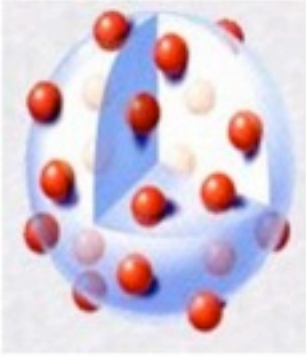

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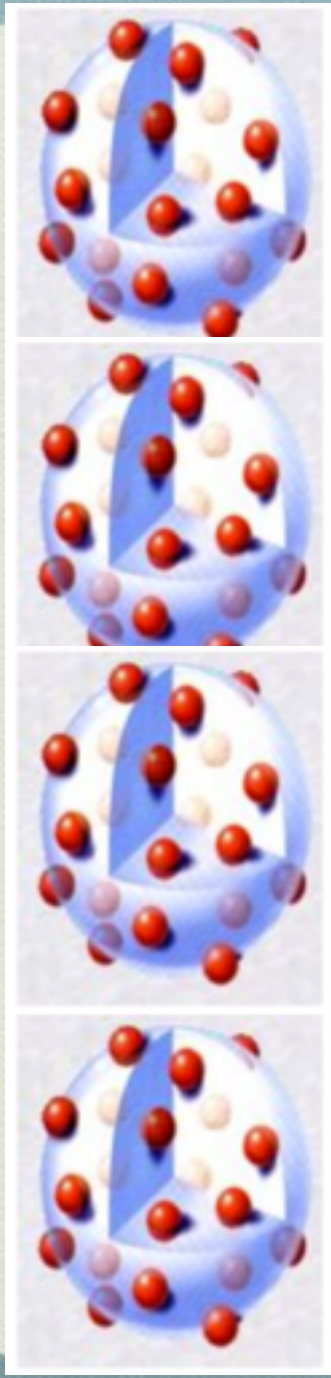

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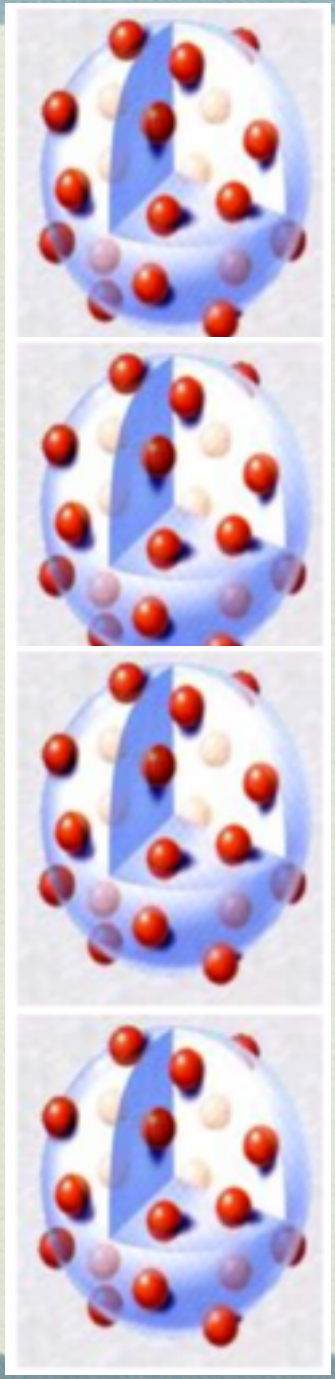

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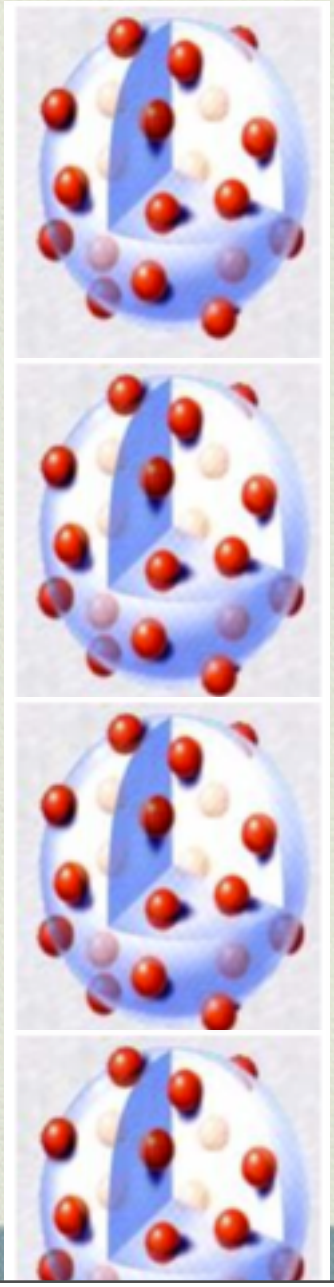

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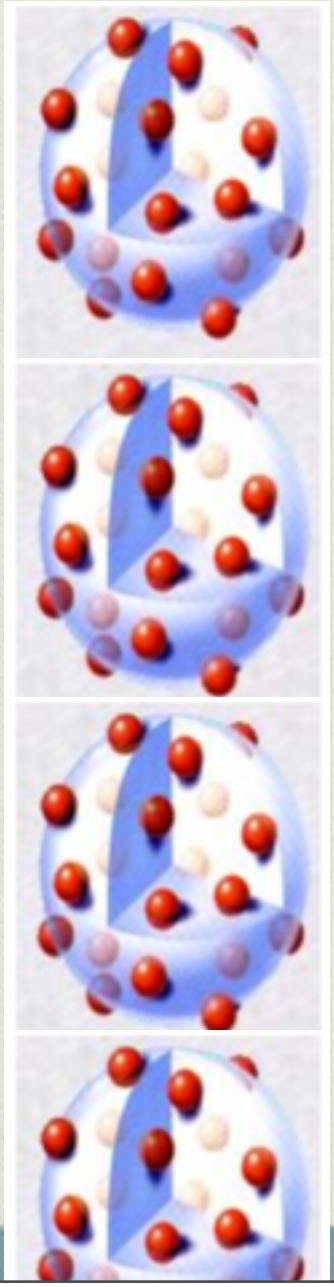

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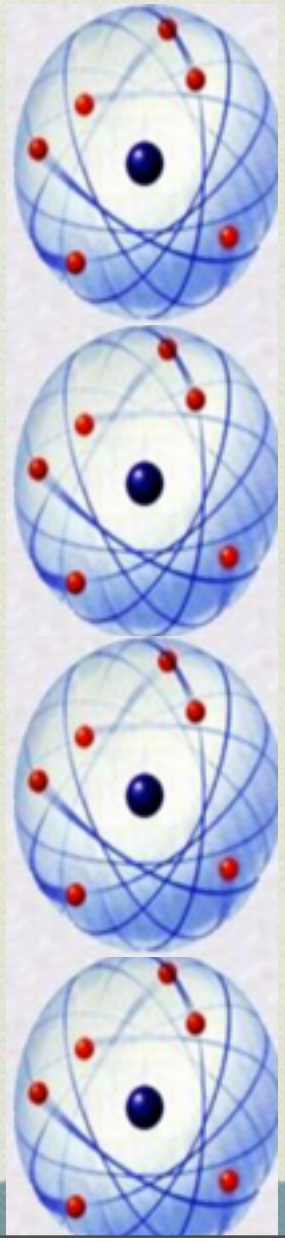

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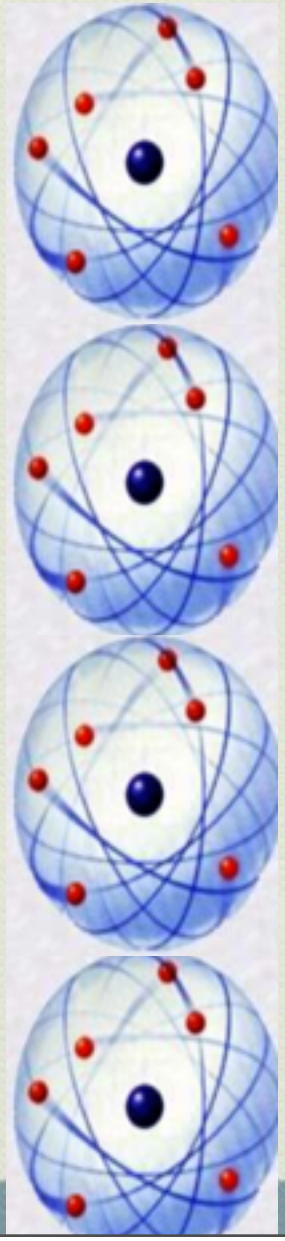

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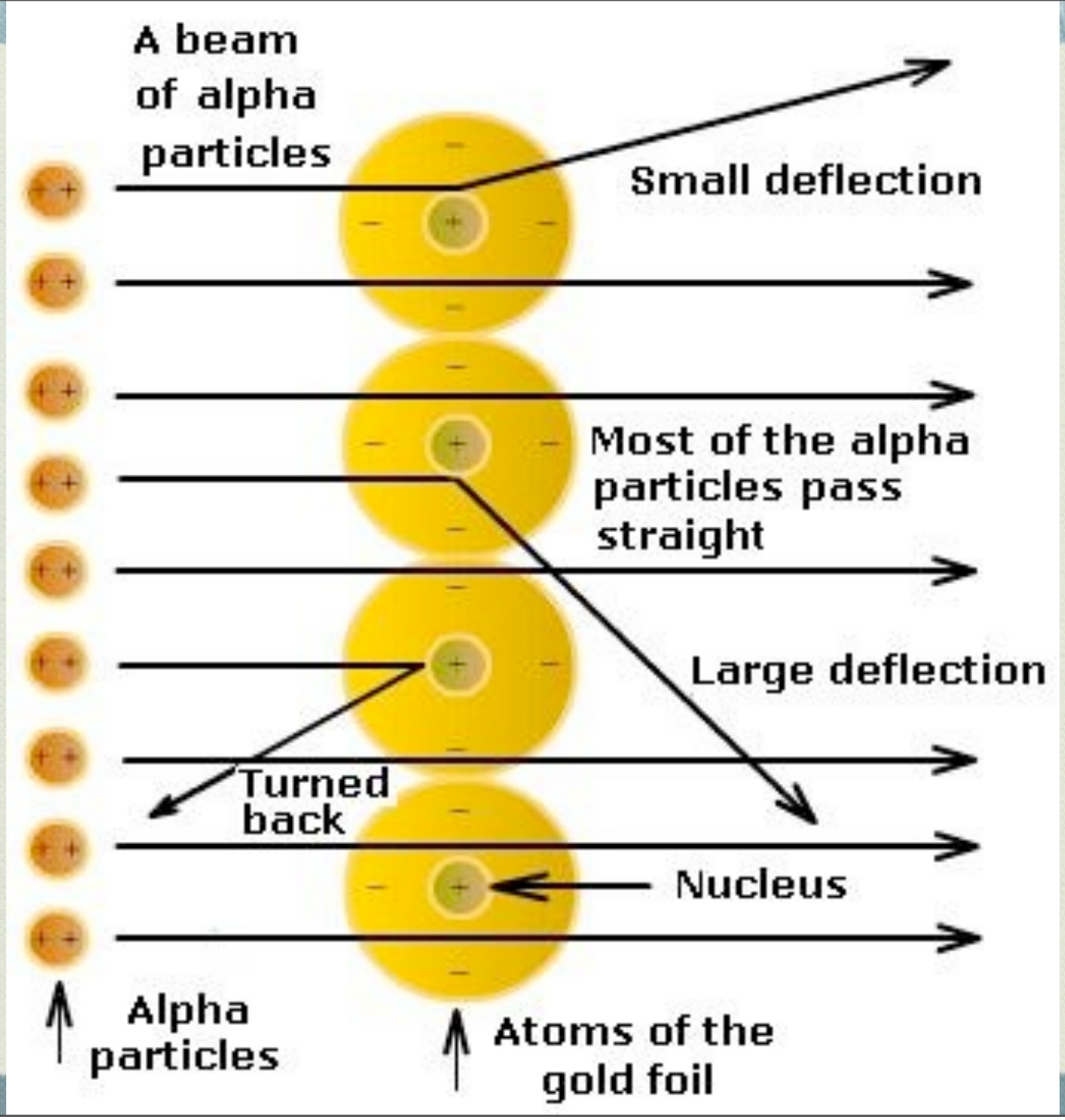
A beam of alpha particles
Small deflection
Most of the alpha particles pass straight
Large deflection
Turned back
Nucleus
Alpha particles
Atoms of the gold foil

b. Rutherford's proposed a more detailed model with a **central nucleus**.

i. **positive charge** was all in a central nucleus.

ii. Electrons held in place by electrical attraction

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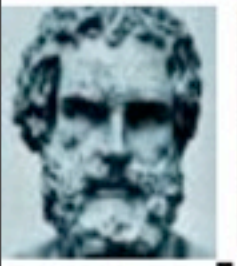

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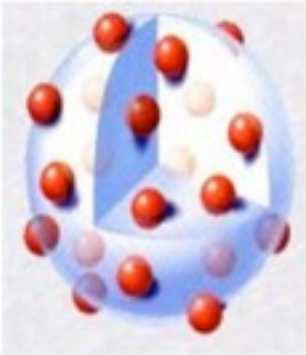

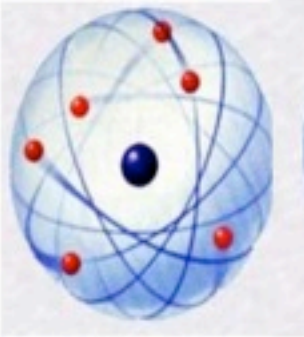

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1. Bohr refined Rutherford's idea by adding that the electrons were in **orbits**.
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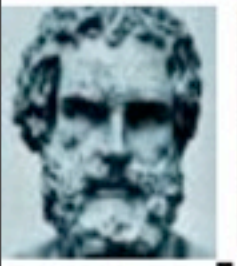

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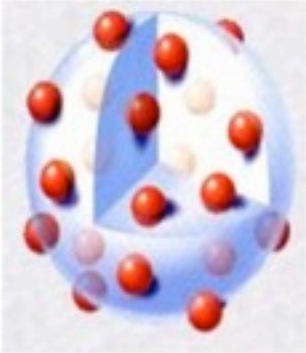
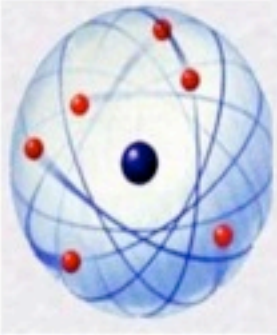
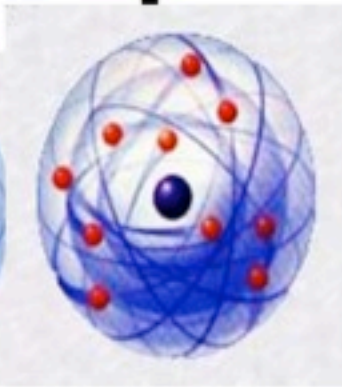
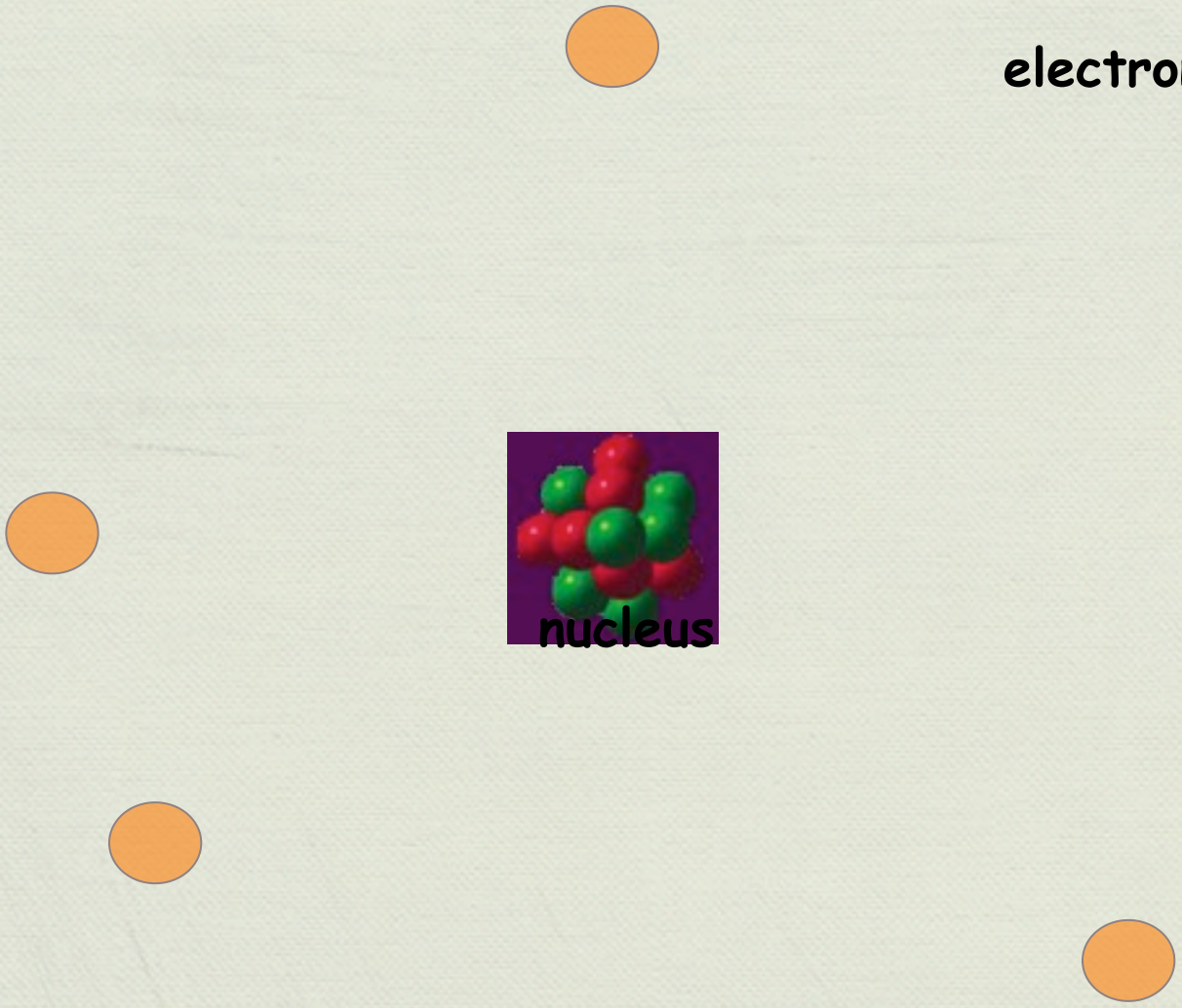




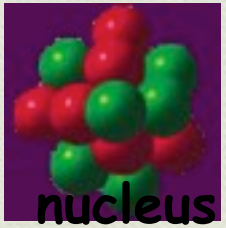


Bohr's Atom



Bohr's Atom

electrons in orbits



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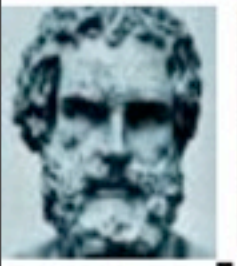

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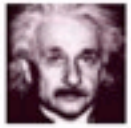
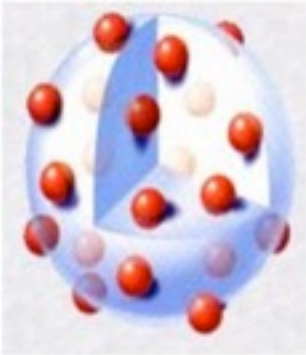
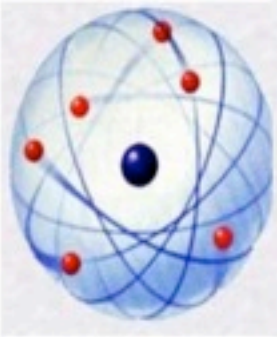
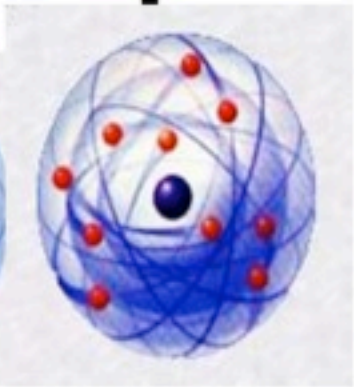
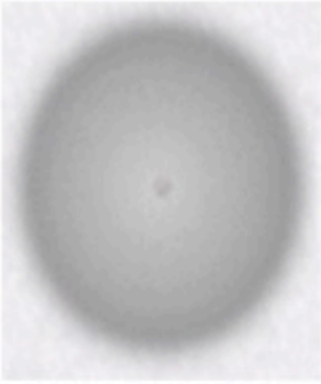
Modern Quantum Cloud Model post 1930



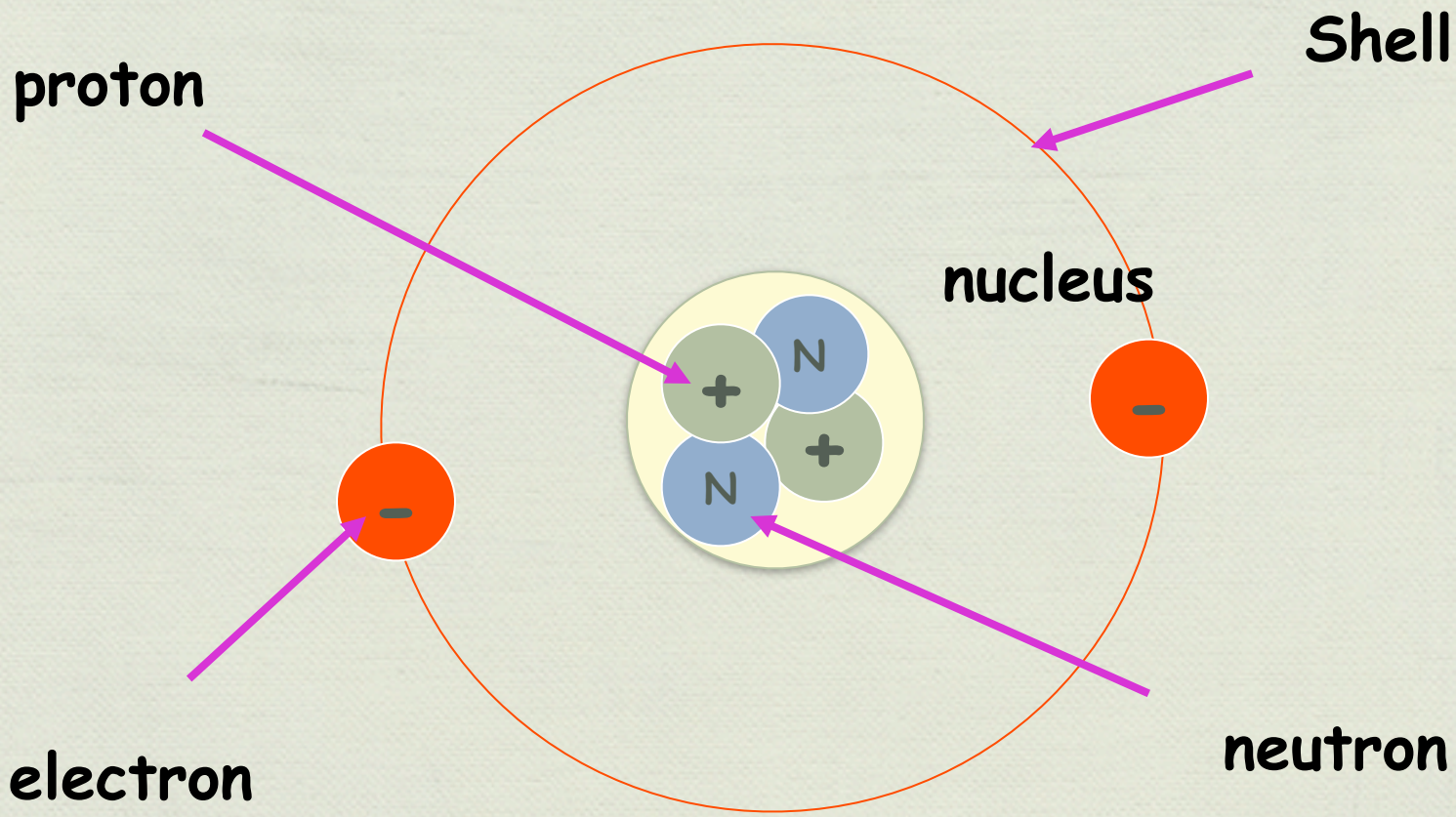








HELIUM ATOM



III. Atomic Structure

Particle	Charge	Mass
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electron		

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$$He^{4}_{2}$$

To find the number of neutrons ....

Take the atomic mass (rounded) - the atomic # = # of neutrons

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IN A STABLE ATOM

number of electrons = number of protons

To find the number of neutrons ....

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third shell a maximum of → 8 electrons

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2. Electrons fill lower shells before outer shells

$$^{14}_{7}N$$

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Nitrogen

14

N

7

1st shell - 2

2nd shell - 5

2 + 5 = 7

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a) $^{40}_{20}Ca$

b) $^{23}_{11}Na$

c) $^{16}_{8}O$

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e) $^{28}_{14}Si$

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14, 14, 14

f) $^{11}_{5}B$

- Determine the number of protons, neutrons and electrons in each stable atom

a) $^{40}_{20}Ca$

20, 20, 20

b) $^{23}_{11}Na$

11, 11, 12

c) $^{16}_{8}O$

8, 8, 8

d) $^{35}_{17}Cl$

17, 17, 18

e) $^{28}_{14}Si$

14, 14, 14

f) $^{11}_{5}B$

5, 5, 6

Indicate the number of electrons in each shell

a) $^{40}_{20}Ca$

b) $^{23}_{11}Na$

c) $^{16}_{8}O$

d) $^{35}_{17}Cl$

e) $^{28}_{14}Si$

f) $^{11}_{5}B$

Indicate the number of electrons in each shell

a) $^{40}_{20}Ca$

2,8,8,2

b) $^{23}_{11}Na$

c) $^{16}_{8}O$

d) $^{35}_{17}Cl$

e) $^{28}_{14}Si$

f) $^{11}_{5}B$

Indicate the number of electrons in each shell

a) $^{40}_{20}Ca$

2,8,8,2

b) $^{23}_{11}Na$

2,8,1

c) $^{16}_{8}O$

d) $^{35}_{17}Cl$

e) $^{28}_{14}Si$

f) $^{11}_{5}B$

Indicate the number of electrons in each shell

a) $^{40}_{20}Ca$

2,8,8,2

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Indicate the number of electrons in each shell

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2,8,8,2

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c) $^{16}_{8}O$

2,6

d) $^{35}_{17}Cl$

2,8,7

e) $^{28}_{14}Si$

f) $^{11}_{5}B$

Indicate the number of electrons in each shell

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2,8,8,2

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e) $^{28}_{14}Si$

2,8,4

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2,8,7

e) $^{28}_{14}Si$

2,8,4

f) $^{11}_{5}B$

2,3

C. With lewis dot & cross diagrams atoms and compounds are represented by dots or crosses to show electrons, and circles to show the shells. For example;

$$^{14}_{7}N$$

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Nitrogen

$^{14}_{7}N$

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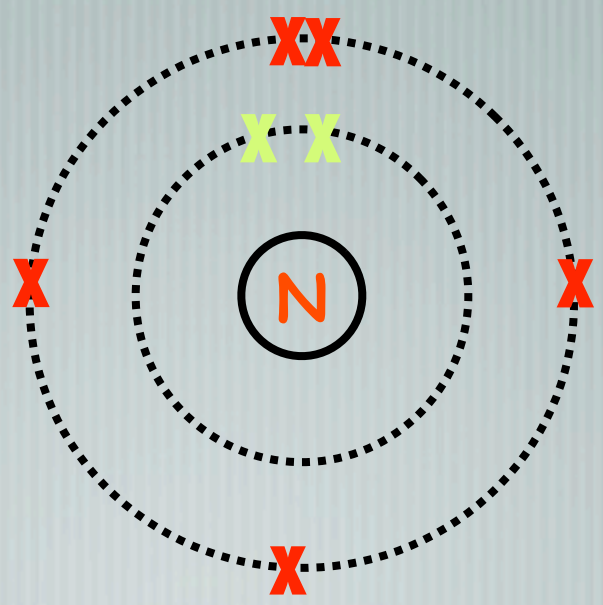
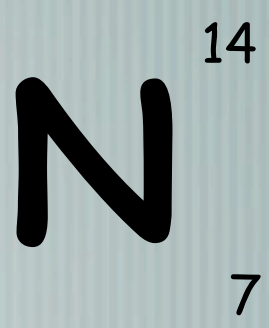
Nitrogen

1st shell - 2

2nd shell - 5

3rd shell - 0





Bohr Model & CROSS DIAGRAMS

Draw the Dot & Cross diagrams for the following elements;

a) $^{16}_{8}O$

b) $^{35}_{17}Cl$

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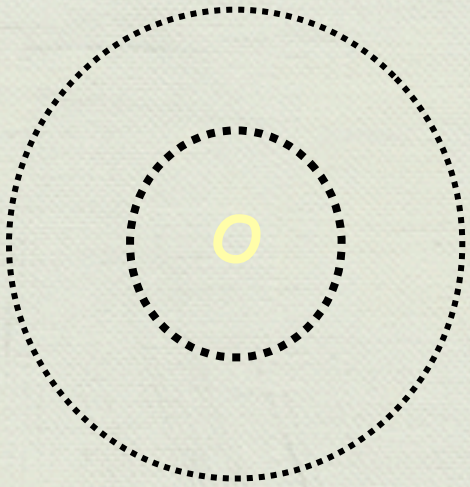

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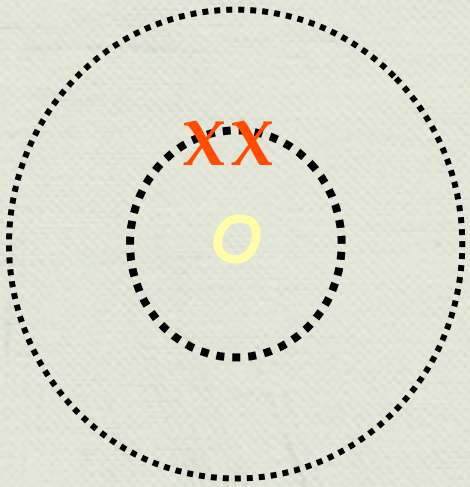

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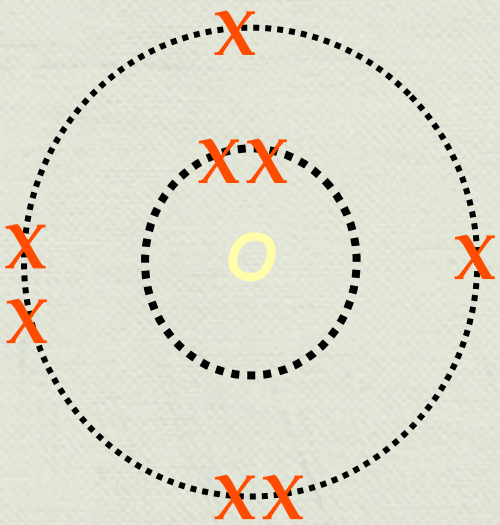

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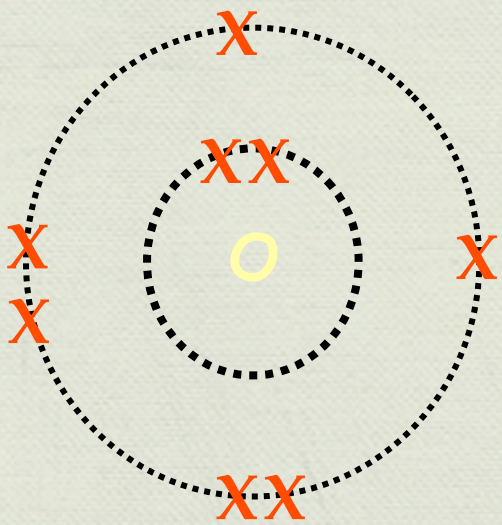

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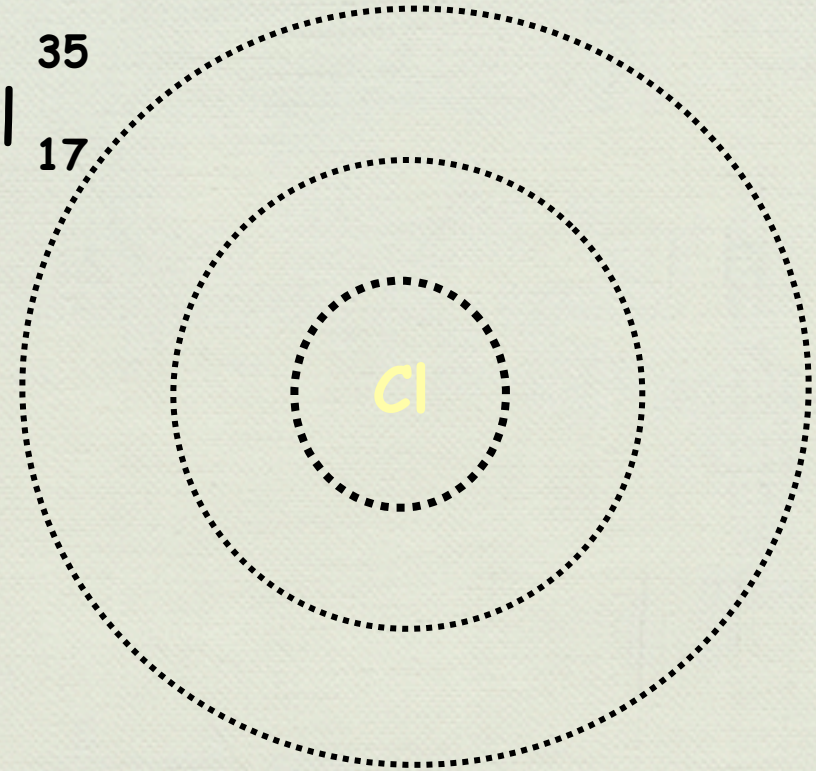

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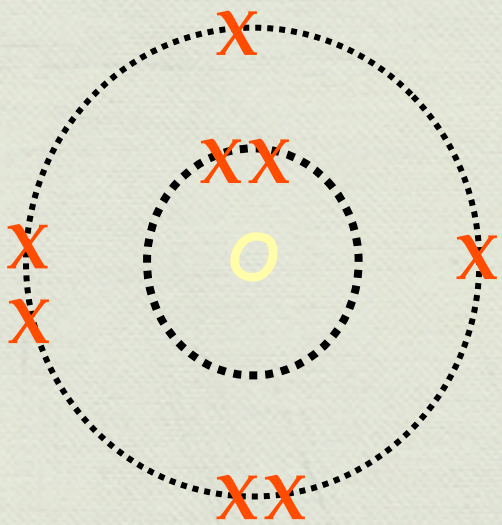

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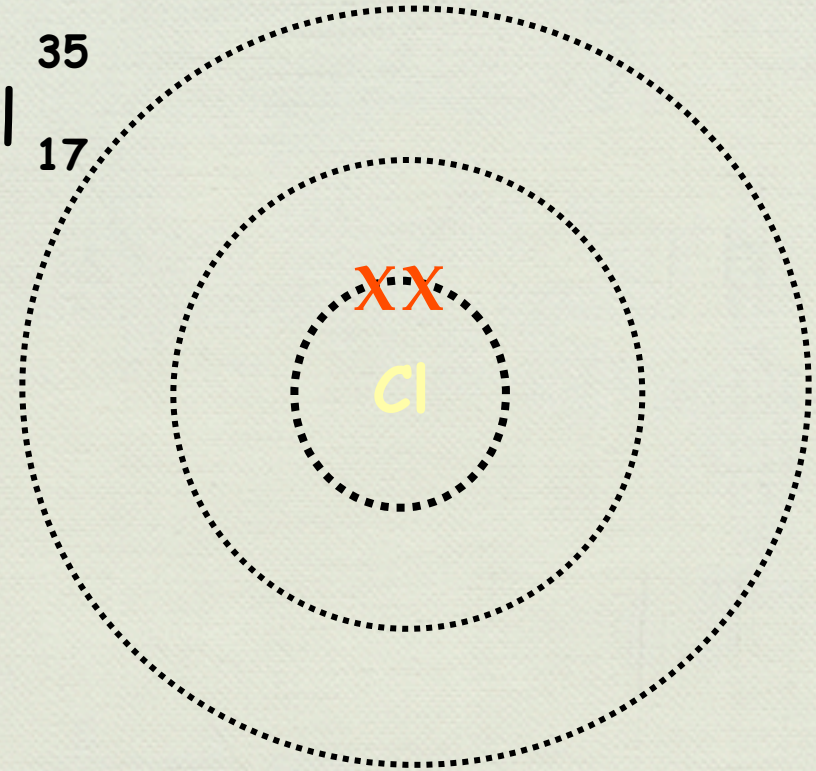

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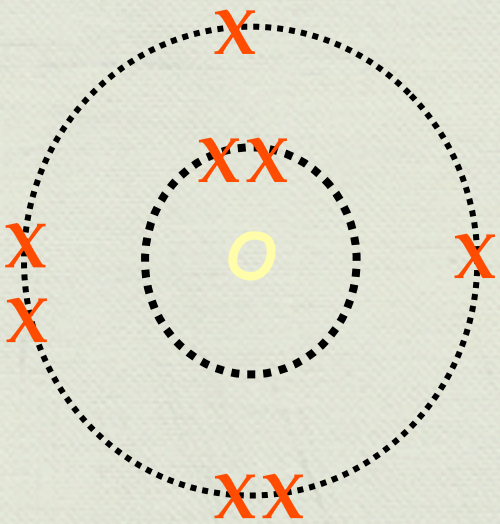

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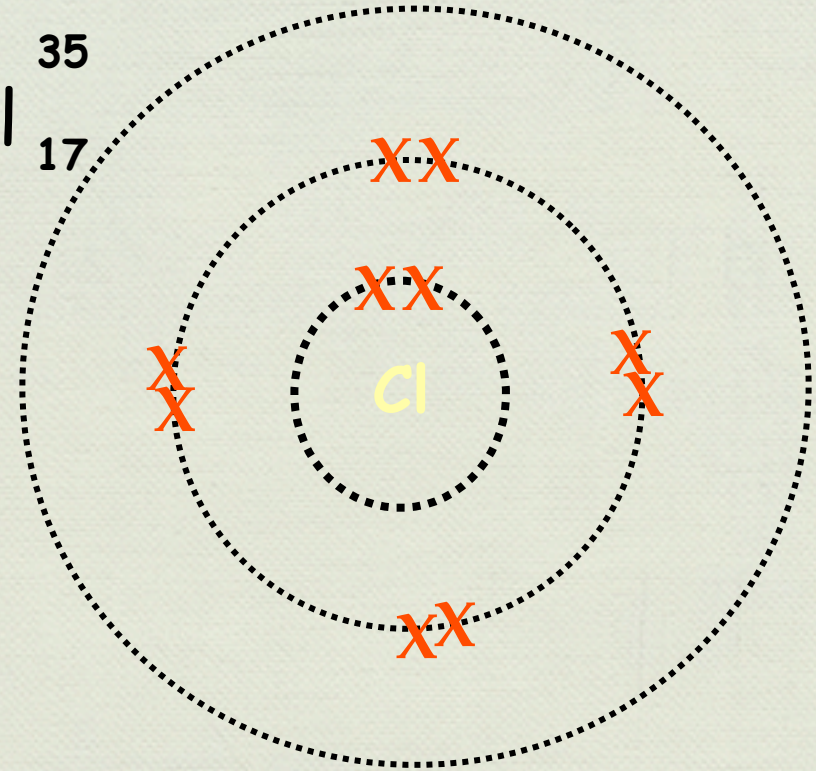

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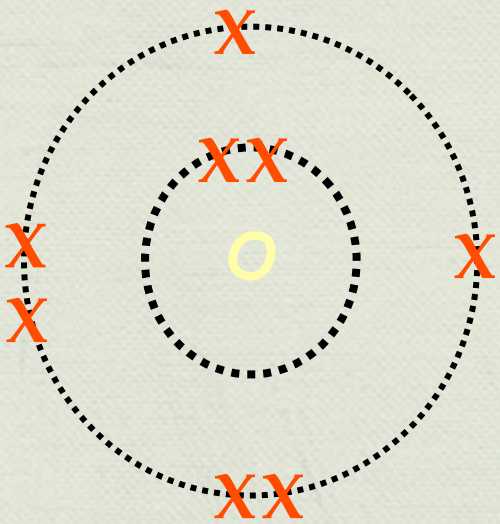

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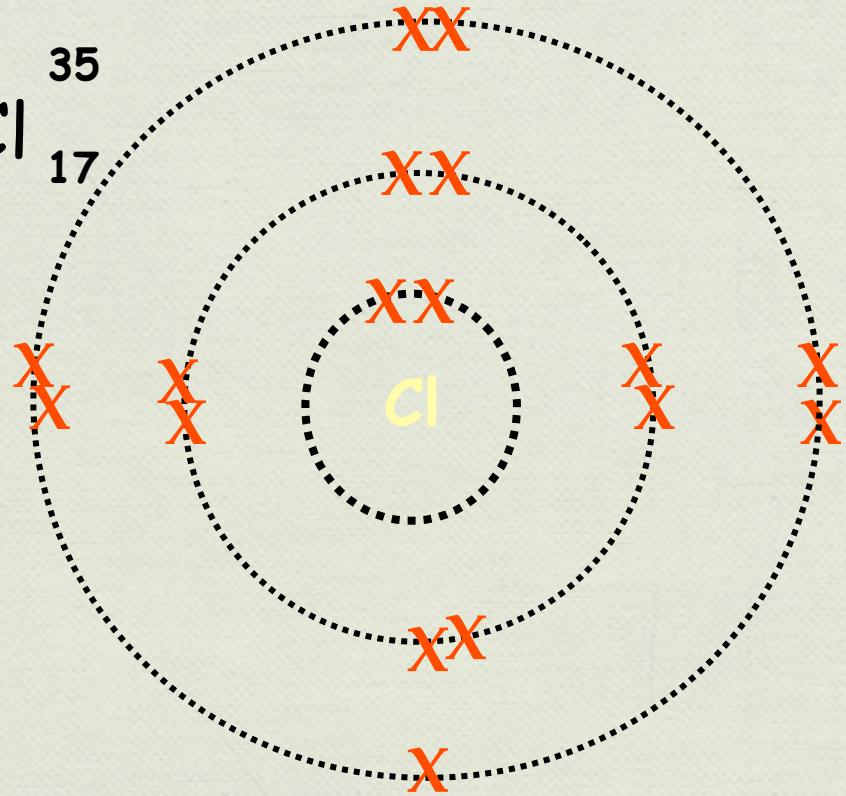
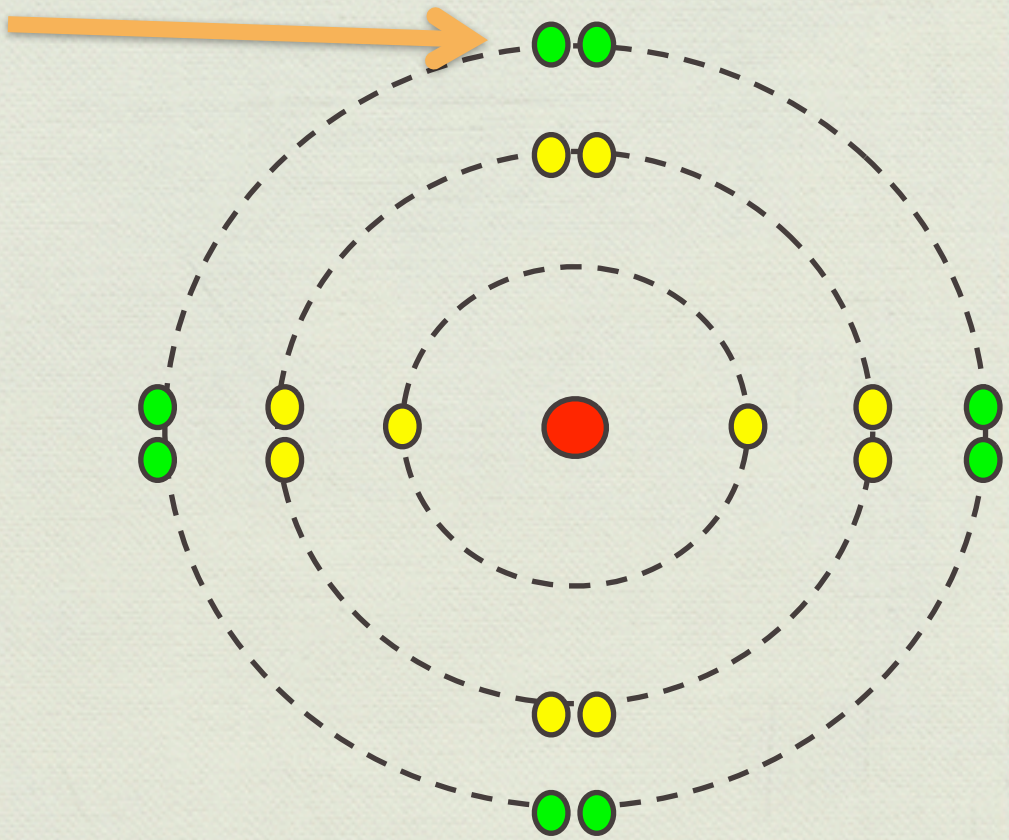


D. Valance Electrons: Electrons in the outer most shell



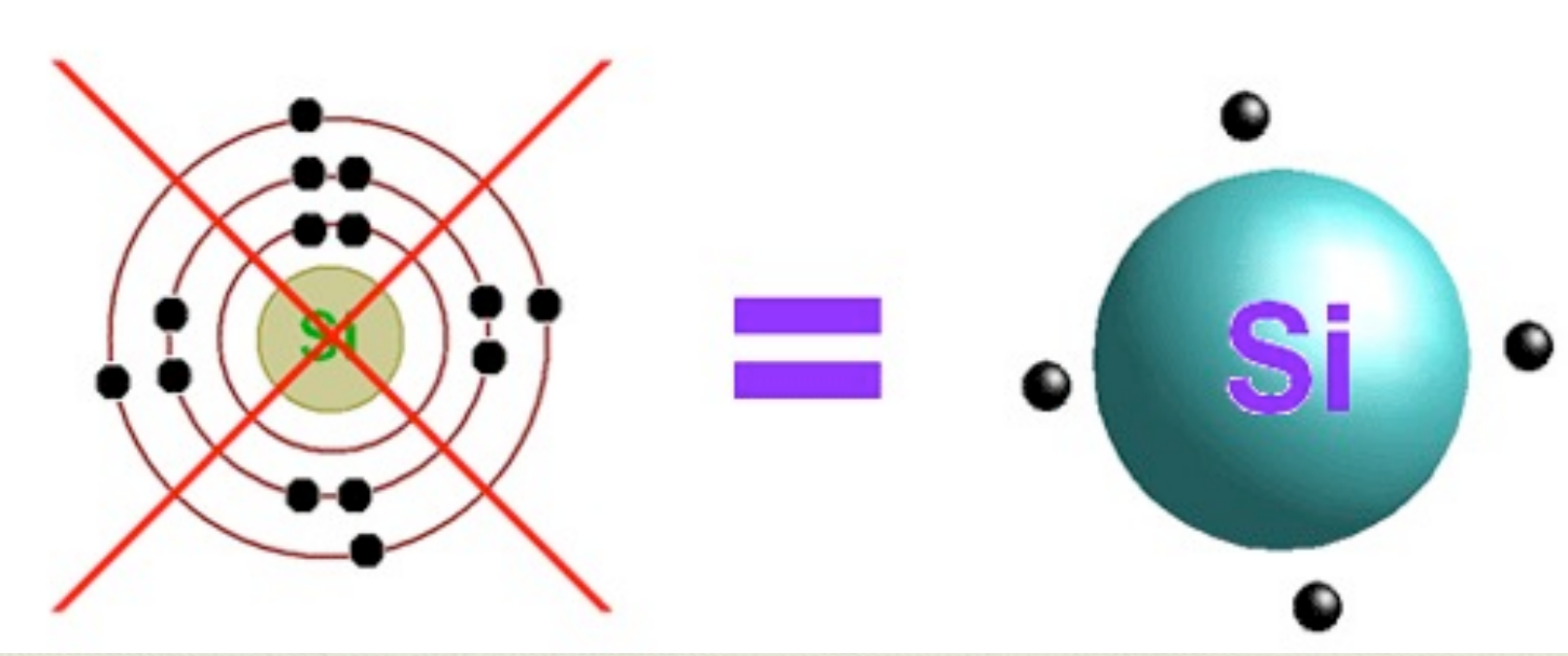
5. Determines how atoms react with other atoms

- To find # of Valance electrons count across the top of the periodic table (skipping the transition metals in the "d - block").

1 2 … 3 4 5 6 7 8

hydrogen 1 H 1.0079							helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305	aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]		ununquadium 114 Uuq [289]				

E. Lewis Dot Model: showing an atom using only the valence electrons.



E. Isotopes: Elements with equal protons but different number of neutrons.

EX CARBON

$$C^{12}_{6} \qquad C^{14}_{6}$$

- Outer shells are most stable when full. Atoms will react with other atoms to become more stable.

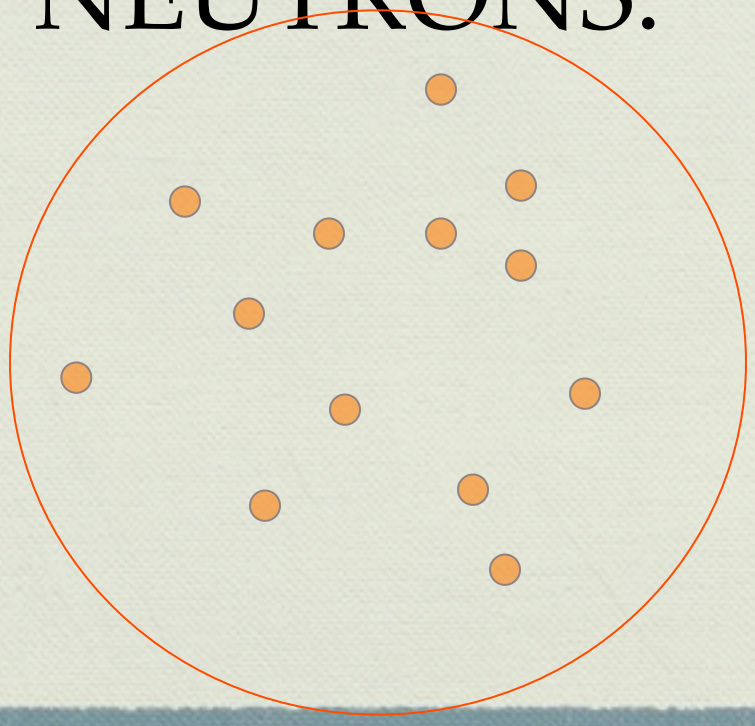
- The charge of the atom is how many electrons it will give/donate or take /accept from other atoms

- If the charge is + the atom has electrons to donate

QUARKS

THE SUB-ATOMIC PARTICLES THAT MAKE UP PROTONS AND NEUTRONS.

PROTON OR NEUTRON



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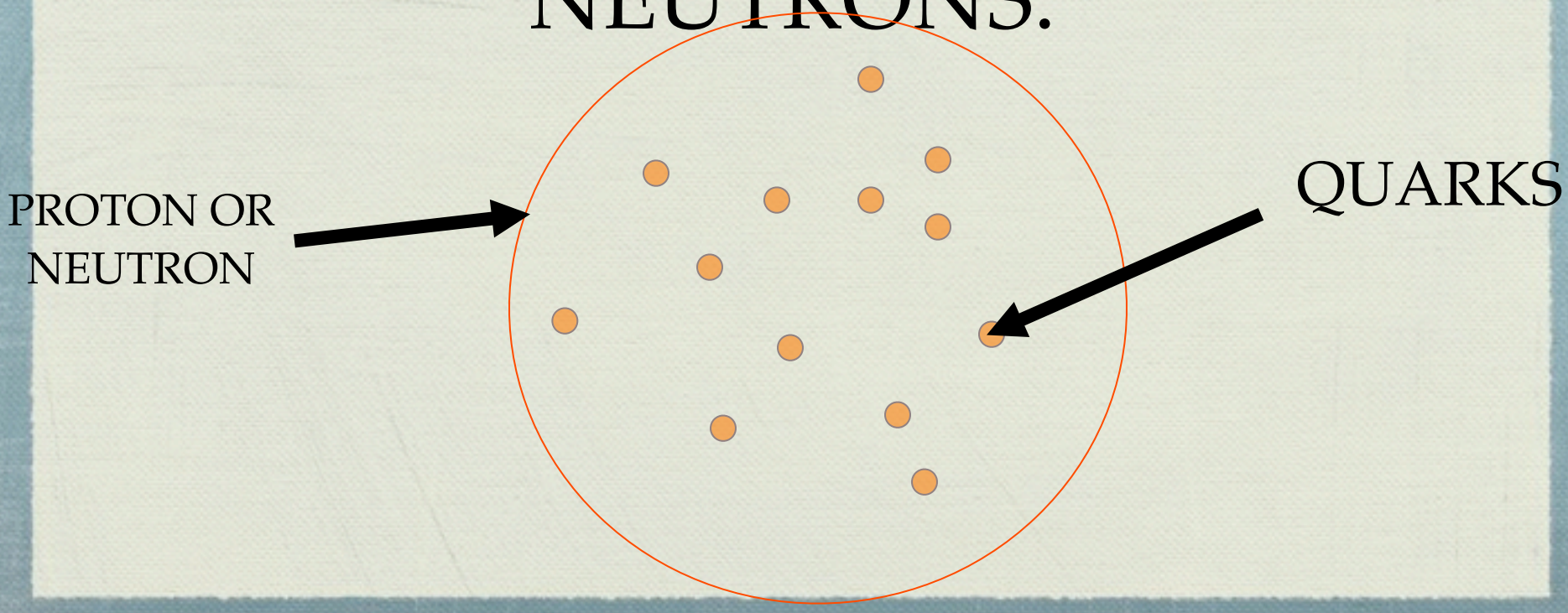

SUMMARY

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1. The **Atomic Number** of an atom = number of protons in the nucleus.

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SUMMARY CONTINUED

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6. An _____ is when two elements have the same number protons but have a different number of neutrons.

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7. A _____ is a sub-atomic particle that makes up Protons and Neutrons

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6. An Isotope is when two elements have the same number protons but have a different number of neutrons.

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SUMMARY CONTINUED

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7. A Quark is a sub-atomic particle that makes up Protons and Neutrons

8. Electrons are found in the

SUMMARY CONTINUED

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7. A Quark is a sub-atomic particle that makes up Protons and Neutrons

8. Electrons are found in the electron cloud.